Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Big Sandy River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Louisa, Ky	26	20	25.5	6	4.2	5	9.7	21.3
Cumberland River.								
Burnside, Ky	434	50	58.1	5	4.3	25	12.2	53.8
Carthage, Tenn	257	30	42.5	7	5.4	25	17.5	37.1
Nashville, Tenn	175	40	42.2	9,10	9.1	25	22.9	33.1
Great Kanawha River.								
Charleston, W. Va	61	30	9.1	11	4.3	26,27	6.2	4.8
New River.								
Radford, Va	153	14	2.7	6	0.7	27,30	1.3	2.0
Hinton, W. Va	95	14	4.7	7,11	2.1	30	3.0	2.6
Licking River.								
Falmouth, Ky	30	25	17.6	9	2.7	3,4	5.4	14.9
Miami River.								
Dayton, Ohio	69	18	7.1	10	2.0	{3,4,22,25,28,29}	3.1	5.1
Monongahela River.								
Weston, W. Va	161	18	3.6	9	−0.3	30	0.5	3.9
Fairmont, W. Va	119	25	8.1	10	0.9	30	2.8	7.2
Morgantown, W. Va	95	20	13.6	10	7.4	29,30	8.8	6.2
Greensboro, Pa	81	18	13.0	10	7.6	27-30	9.0	5.4
Lock No. 4, Pa	40	28	17.0	10	6.9	30	9.6	10.1
Cheat River.								
Rowlesburg, W. Va	36	14	6.0	10	1.6	28,29	3.2	4.4
Youghiogheny River.								
Confluence, Pa	59	10	6.9	10	1.4	24	2.9	5.5
West Newton, Pa	15	23	7.6	10	1.1	30	2.6	6.5
Tennessee River.								
Knoxville, Tenn	614	29	.....	.....	.....	.....	.....	.....
Rockwood, Tenn	519	20	.....	.....	.....	.....	.....	.....
Chattanooga, Tenn	430	33	30.8	6	5.8	30	12.4	25.0
Bridgeport, Ala	390	24	22.8	7	4.2	28	9.9	18.6
Florence, Ala	220	16	18.3	10	4.2	29	10.4	14.1
Johnsonville, Tenn	94	21	40.1	1	7.2	30	23.1	32.9
Wabash River.								
Terre Haute, Ind	165	16	11.2	14	4.5	23	7.4	6.7
Mt. Carmel, Ill	50	15	19.5	17	8.0	25	14.1	11.5
Red River								
Arthur City, Tex	688	27	9.7	1	3.5	26	6.5	6.2
Fulton, Ark	565	28	25.9	1,2	6.5	30	15.4	19.4
Shreveport, La	449	29	24.1	13,14	14.5	30	21.2	9.6
Alexandria, La	139	33	26.3	15-16	21.5	30	24.5	4.8
Atchafalaya River.								
Melville, La	100*	31	35.7	29,30	33.5	1	34.8	2.2
Ouachita River.								
Camden, Ark	340	39	24.8	18	8.1	30	17.5	16.7
Monroe, La	100	40	37.9	9-12	35.6	30	37.0	2.3
Yazoo River.								
Yazoo City, Miss	80	25	31.5	27,30	26.4	1	29.6	5.1
Tombigbee River.								
Columbus, Miss	285	33	11.7	10	0.2	24,25	5.4	11.5
Demopolis, Ala	155	35	52.4	1	5.9	29	27.7	46.5
Black Warrior River.								
Cordova, Ala	155	20	16.0	10	3.4	29	6.2	12.6
Tuscaloosa, Ala	90	38	29.4	11	5.1	29	16.0	24.3

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Alabama River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Montgomery, Ala	265	35	22.3	11	4.8	29	11.1	17.5
Selma, Ala	212	35	25.0	12	7.0	28-30	14.1	18.0
Coosa River.								
Rome, Ga	225	30	18.9	6	3.2	30	7.1	15.7
Wilsonville, Ala	66	15	10.0	10	3.4	30	5.6	6.6
Tallapoosa River.								
Sturdevant, Ala	69	15	3.8	10	1.8	28,29	2.6	2.0
Savannah River.								
Augusta, Ga	130	32	28.5	6	8.5	29,30	13.1	20.0
Edisto River.								
Edisto, S. C	75	6	5.3	11	3.3	29,30	4.6	2.0
Congaree River.								
Columbia, S. C	37	15	15.5	6	0.9	22	3.6	14.6
Santee River.								
St. Stephens, S. C	50	12	11.5	14	6.8	30	8.6	4.7
Wateree River.								
Camden, S. C	45	24	28.6	7	6.3	28	10.7	22.3
Black River.								
Kingstree, S. C	60	12	7.9	17	4.9	30	6.7	3.0
Pedee River.								
Cheraw, S. C	145	27	30.4	7	3.4	27,28	9.3	27.0
Linch Creek.								
Effingham, S. C	35	12	12.3	13	4.3	29	7.8	8.0
Lumber River.								
Fair Bluff, N. C	10	6	5.3	17,18	2.9	30	4.5	2.4
Waccamaw River.								
Conway, S. C	40	7	4.4	1	1.6	29,30	3.0	2.8
Cape Fear River.								
Fayetteville, N. C	100	38	28.3	7	4.4	30	11.8	23.9
James River.								
Lynchburg, Va	257	18	2.5	7,9	1.0	26,29,30	1.6	1.5
Richmond, Va	110	12	1.6	9	0.1	29,30	0.6	1.5
Potomac River.								
Harpers Ferry, W. Va	170	16	5.0	11	1.5	30	2.6	3.5
Susquehanna River.								
Wilkesbarre, Pa	178	14	.....	.....	.....	.....	.....	.....
Harrisburg, Pa	70	17	9.5	12	3.2	30	5.2	6.3
W. Br. of Susquehanna.								
Lock Haven, Pa	63	10	4.0	10	1.3	5-7,28-30	2.2	2.7
Williamsport, Pa	35	20	8.3	11	2.7	30	4.8	6.1
Juniata River.								
Huntingdon, Pa	80	24	6.7	10	3.8	30	4.5	2.9
Sacramento River.								
Redbluff, Cal	241	23	8.1	17-19	5.8	7	7.3	2.3
Sacramento, Cal	70	28	23.8	22	19.9	1	21.1	2.9
Willamette River.								
Eugene, Oreg	149	10	.....	.....	.....	.....	.....	.....
Albany, Oreg	99	20	.....	.....	.....	.....	.....	.....
Salem, Oreg	69	20	.....	.....	.....	.....	.....	.....
Portland, Oreg	10	15	18.4	23	7.6	5	13.4	10.8

*Distance to the Gulf of Mexico. †Mean for 29 days. •Frozen, 1-4.

SPECIAL CONTRIBUTIONS.

RECENT PUBLICATIONS.

By HERMAN W. SMITH, Librarian, Weather Bureau.

The Chief of the Weather Bureau has directed that there be published regularly in the REVIEW a list of recent publications received by the Library. In the following list the publications, not only of the Department of Agriculture, but of the Government in general, are omitted, as their titles are already accessible to the public through the publications issued by the Superintendent of Public Documents. The present list includes only such other works as seem to bear directly on meteorology and other matters connected with the work of the Weather Bureau. It is to be understood that those who wish to consult these works must do so in Washington, where every convenience for study is afforded.

Austria-Hungary.—Jahrbücher der Königl. Ung. Central-Anstalt für Meteorologie und Erdmagnetismus. Officielle Publication, XXIII Band, Jahrg. 1893. Budapest, 1895. 4to. xix, 169 pp.

Belgium.—Congrès de l'Atmosphère. Organisé sous les auspices de la Société royale de Géographie d'Anvers, 1894. Compte Rendu. Anvers, 1895. 8vo. 272 pp.

Brazil.—Relatorio annual do Instituto Agronomico do estado de Sâo Paulo (Brazil) em Campinas. Vol. VII-VIII, 1894-1895. S. Paulo, 1896. 4to.

British Empire.

Canada.—Twenty-second Annual Report of the Ontario Agricultural College and Experimental Farm. Eighteenth Annual Report of the Agricultural and Experimental Union, 1896. Toronto, 1897. 8vo. xxiv, 309 pp.

England.—Report of the Kew Observatory Committee of the Royal Society for the year ending December 31, 1896. London, 1897. 8vo. 34 pp.

Report of the Meteorological Council of the Royal Society for the year ending 31st of March, 1896. London, 1896. 8vo. 129 pp. 1 map, 10 by 15.

Memoranda of the Origin, Plan, and Results of the Field and Other Experiments Conducted on the Farm and in the Laboratory of Sir John Bennet Lawes, at Rothamsted, Herts. London, 1896. 8vo. 105 pp.

Transactions and Fifth Annual Report of the Council of the Liverpool Geographical Society for the year ending December 31, 1896. Liverpool, 1897. 8vo. 125 pp. 1 plate and 1 chart.

Denmark.—Mémoires de l'Académie Royale des Sciences et des Lettres de Danemark, Copenhague. En Mathematisk Undersogelse af, hvorvidt Vaedsker og deres Dampe kunne have en faelles Tilstandsligning, baseret paa en kortfattet Fremstilling af Varmetheoriens Hovedsaltninger. Ved F. Buchwaldt. Kjobenhavn, 1896. 4to. pp. Del 110-172.

France.—Météorologie Agricole, par F. Houdaille. Paris, n. d. 16mo. 204 pp.

Traité Pratique de Prévision du Temps, par J. R. Plumandon. Paris, 1895. 12mo. 86 pp. 19 charts and 11 tables.

Germany.—Forschungen auf dem Gebiete der Agrikulturphysik. 19 Band, 4 u. 5 Heft. Dr. E. Wollny. Heidelberg, 1896. 8vo. ix, 209 pp. 1 plate.

Russia.—Beobachtungen des Tiflisser Observatoriums im Jahre 1895. (1895.) Tiflis, 1897. 4to. xxix, 198 pp.

United States of America.

Bowker, R. R. United States Government Publications, July 1, 1890–June 30, 1895. Compiled, under the editorial direction of R. R. Bowker, by J. H. Hickox. (Reprint of Appendix of American Catalogue, 1890–1895.) New York, 1896. 10 by 11. 60 pp.

United States Navy Department, Hydrographic Office. Illustrated Cloud Forms for the Guidance of Observers in the Classification of Clouds. C. D. Sigsbee, Captain United States Navy, Hydrographer. Washington, 1897. 5½ by 9½. 16 plates.

District of Columbia.—Report of the Health Officer of the District of Columbia for the year 1896. Washington, D. C., 1896. 8vo. 277 pp. 6 charts, 30 by 30.

Michigan.—Twenty-second Annual Report of the Secretary of the State Board of Health of the State of Michigan for the fiscal year ending June 30, 1894. Lansing, 1896. 8vo. cciv, 526 pp.

Proceedings and Addresses of the Third Annual Conference of the Health Officers in Michigan, held at the State Laboratory of Hygiene, State University, Ann Arbor, Mich., July 16–17, 1896. Lansing, 1896. 8vo. 139 pp.

New Jersey.—Seventh Annual Report of the Board of Directors of the New Jersey Weather Service for the year 1896. Trenton, 1897. 8vo. 240 pp. 4 maps, 10 by 14.

THE EARLY USE OF WIRE IN KITE FLYING.

By S. P. FERGUSSON (dated Blue Hill Observatory, April 9, 1897).

After the account of the high kite ascension at Blue Hill on October 8, 1896, was published, I received a letter from Mr. Thomas H. Butler, of Providence, R. I., giving an account of some experiments in kite flying made by him and his friends in England about forty years ago. Mr. Butler stated that iron wire was employed as line, and sometimes 2 or 3 miles were let out and taken up by the kites. Strong electric shocks were experienced by those holding the line.

As Archibald, of England, had received credit for being the first, in 1883 and 1884, at the suggestion of Sir William Thomson, to make use of steel wire for kite line, Mr. Butler's letter was interesting, especially in regard to the early use of wire, and to the altitudes reached. I wrote him asking for further information, and he corresponded with some friends in Bradford, England, who sent him two clippings from the *Bradford Observer Budget*, and a letter, which Mr. Butler has kindly sent me. I copy Mr. Butler's letter (1) and the newspaper extracts (2 and 3) below, as also (4) Mr. Pyrah's letter of January 30, and append a few additional remarks (5):

(1) *Letter from Mr. Thomas H. Butler, of Providence, R. I., to S. P. Fergusson.*—Please find enclosed a little information toward proving my previous statement regarding the early use of wire as a kite line. * * * For a five-foot tall kite, we used small cane or brier for the bow with a strong lath for the perpendicular or backbone as I will call it, and good twine. But for a giant kite such as you would require the bow wants to be made of lancewood such as used for archery purposes, and the backbone of strong but lighter wood, and in the place of twine use thick, strong wire and you could make a pretty light frame big enough to lift a man. It is a pleasure to see this style of kite go up. When she strikes the wind as soon as she is let loose she is as graceful and pliable as a bird. I believe a giant kite constructed after the above design would reach a higher altitude than has been reached yet with a great deal less expense and trouble. * * *

(2) *Extract from Bradford Observer Budget of February*, 1897.—In reply to your correspondent who writes for information in respect to flying kites with wire in Bierly Lane, Bradford, I beg to inform you that I remember that Mr. Joshua Law had a wire mill close to Bierly Lane, and he had at that time three men in his employ, namely, George Walker, Solomon Shires, and Christopher Firth, and I have seen these men fly kites with two and a half miles of wire more than fifty years ago; and if a piece of string was tied to the end of the wire nearest the hand, on touching the wire quite a strong electric shock was felt. The Mr. Butler who writes to you from Olneyville, U. S. A., I have known from childhood, but he being quite twenty years my junior may not remember the above. I am, etc., WM. WEBSTER.

Black Swan Hotel, Boroughbridge, February 4, 1897.

(3) *Extract from the Bedford Observer Budget of February*, 1897.—I saw the letter of the 4th of February, 1897, from Mr. Webster, Black Swan Hotel, Boroughbridge, and it was quite correct. I have known him ever since he was a boy, and all his family, too. Kite flying with wire was practised at Dudley Hill by workmen from Mr. Joshua Law's wire works 55 years ago, and the kites were sent up with 2½ miles of wire attached to them. In 1842 and 1843 I saw kites sent up and drawn in again, and the electric shocks from them were something terrific. I have seen sparks of fire when the wire was touched with a knife blade, and men and boys severely shaken and some fall to the ground. I have a friend at Low Moor, 60 years of age, who informs me that he used to fly kites with wire 50 years ago at Mr. Dan. Bateman's wire works, and he has seen men fly kites 4 feet long and 2 feet 8 inches wide, with tails attached 20 yards long, and a lantern with a big candle at the end, so that you could imagine the kite was a little star. He also assures me that kite flying was practised 80 years back at Mr. Bateman's works. When Robert Stephenson, the great engineer, was a boy, his father bought him a donkey to ride to school, and while pursuing his journey he used to fly kites with copper wire a mile long; that was 60 years ago. (See his life, page 126.) For fun he used to touch the head of the donkey with the wire, and of course the donkey knew about it. Kite flying has been practised in England with iron wire, steel wire, and copper wire. Hoping this will satisfy our American friends who think that kite flying with wire is of recent introduction, I am, etc., JOHN PYRAH.

8 Heeles street, Tong street, near Bradford.

(4) *Letter of Mr. Pyrah addressed to Mr. Butler.*—Having seen your correspondence on kite flying with wire, I will give you facts which I witnessed fifty-six years ago. The works of Mr. Law's, wire drawer and card manufacturer, were at Goose Hill, now called Rooley Lane, near Bradford, in Yorkshire, and their workmen tried kite flying for a whole summer by the White Heart publick house in my presence in 1842, fifty-six years ago. I was then fourteen years old, and lived at the place. I was sadly shaken myself when I was asked to touch the wire, and a great many were laid on their backs by the electric currents; at last they were ordered to give over before some one was killed. I saw it strike fire sparks when touched with a penknife or a button. This statement could be verified by many. I am rather surprised to hear that scientific men such as you name should not have known and published this before 1884. (Dated Bradford, January 30, 1897.)

(5) *Remarks by S. P. Fergusson.*—The kite described by Mr. Butler is very simple, consisting of a rather stiff upright stick, over the top end of which a flexible stick or cane is bent in the form of a bow. Cords from the ends of the bow extend to the lower end of the upright, and the covering is secured to the bow and to these cords. The bridle is attached at two points on the upright near the middle of the kite. The tail appears to be of cord, to which are attached short pieces of cloth or paper. Archibald's kites differed from this pattern in that they were diamond shaped, having no bow at the top, and in the use of a cone tail. The wire used by Mr. Butler and his friends was ordinary iron wire, about the diameter of a large pin.

Mr. Rotch has found in the English Mechanic of September 8, 1876, a letter from A. Willan, describing some electrical experiments with kites, from which the following is quoted:

I have always flown my electric kites simply with this iron wire (the best Swedish), any length of which can be obtained at places where the combs for wool-carding engines are made. * * * The wire I use is No. 23, B. W. G., but with a light wind a thinner size might with advantage be used. I have it wrapped on a large wooden bobbin and fixed in a wooden frame, so that it winds up with a handle. Care must be taken to avoid "kinks," which invariably result in a breakage of the wire.

From the above it appears that the use of wire for kites is not new; with the long lines employed, considerable altitudes were probably reached.

[It should be noted that Espy and the Franklin Kite Club used wire for flying their kites about 1836 in Philadelphia. See under Notes by the Editor.]

CLOUD MEASUREMENTS AT BLUE HILL.

(By H. H. CLAYTON, dated February 28, 1897.)

At Mr. Rotch's request I send herewith an example of my method of calculating the heights of clouds from the positions of their shadows. The first method we used was by a formula similar to one given by Professor Abbe in describing Feussner's method (see page 322 of his Treatise on Meteorological Apparatus and Methods), and which reads as follows:

$$z_1 = b \sin (a_2 \pm 180° - a_3) \tan h_1 \operatorname{cosec} (a_1 - a_2)$$

In which z_1 is the height of the cloud above Blue Hill; b is the distance to the cloud shadow, as measured on a map of the surrounding region; a_1, a_2, and a_3 are the azimuths of the cloud, sun, and cloud shadow, respectively; h_1 is the observed angular altitude of the cloud.

This, however, was only a partial solution since it gave only the height above one station and no criterion for determining the accuracy. Hence it was soon abandoned and the following modification of the method was adopted. The formulæ are not essentially different from those of Ekholm and Hagstrom (see page 315 of the above-mentioned Treatise).

When a cloud shadow is seen in a favorable position the